

FORM PTO-1390 (Modified)  
(REV 11-2000)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

## TRANSMITTAL LETTER TO THE UNITED STATES

30151/38183

DESIGNATED/ELECTED OFFICE (DO/EO/US)

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR

CONCERNING A FILING UNDER 35 U.S.C. 371

10/069302

INTERNATIONAL APPLICATION NO.  
PCT/EP00/08050INTERNATIONAL FILING DATE  
August 17, 2000PRIORITY DATE CLAIMED  
August 19, 1999

## TITLE OF INVENTION

ANNEALING APPARATUS

## APPLICANT(S) FOR DO/EO/US

Bernd Lohmuller et al

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (24) indicated below.
4. ☐ The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
  - a. ☐ is attached hereto (required only if not communicated by the International Bureau).
  - b. ☒ has been communicated by the International Bureau.
  - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
  - a. ☒ is attached hereto.
  - b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
  - a. ☐ are attached hereto (required only if not communicated by the International Bureau).
  - b. ☐ have been communicated by the International Bureau.
  - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
  - d. ☐ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)). In Blank
10. ☐ An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).
11. ☐ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☐ A copy of the International Search Report (PCT/ISA/210).

## Items 13 to 20 below concern document(s) or information included:

13. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☐ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☐ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
20. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
21. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
22. ☒ Certificate of Mailing by Express Mail
23. ☒ Other items or information: General Authorization; Cover Sheet WIPO Publication WO 01/14603 A1; PCT Form 210; PCT Form 409

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR 1.53) <div style="font-size: 24pt; font-weight: bold; text-align: center;">10/069302</div>		INTERNATIONAL APPLICATION NO. PCT/EP00/08050		ATTORNEY'S DOCKET NUMBER 30151/38183	
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24. The following fees are submitted:

**BASIC NATIONAL FEE ( 37 CFR 1.492 (a) (1) - (5) ) :**

☐ Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO . . . . . **\$1040.00**

☒ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO . . . . . **\$890.00**

☐ International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO . . . . . **\$740.00**

☐ International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) . . . . . **\$710.00**

☐ International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) . . . . . **\$100.00**

**ENTER APPROPRIATE BASIC FEE AMOUNT =**

CALCULATIONS PTO USE ONLY

Surcharge of <b>\$130.00</b> for furnishing the oath or declaration later than months from the earliest claimed priority date (37 CFR 1.492 (e)). <input type="checkbox"/> 20 <input type="checkbox"/> 30				<b>\$0.00</b>	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	29 - 20 =	9 <del>xx</del>	x \$18.00	\$162.00 <del>\$0.00</del>	
Independent claims	3 - 3 =	0	x \$84.00	\$0.00	
Multiple Dependent Claims (check if applicable). <input checked="" type="checkbox"/>				\$280.00 <del>\$0.00</del>	
<b>TOTAL OF ABOVE CALCULATIONS =</b>				1332.00 <del>\$0.00</del>	
<input checked="" type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.				\$666.00 <del>\$0.00</del>	
<b>SUBTOTAL =</b>				\$666.00 <del>\$0.00</del>	
Processing fee of <b>\$130.00</b> for furnishing the English translation later than months from the earliest claimed priority date (37 CFR 1.492 (f)). <input type="checkbox"/> 20 <input type="checkbox"/> 30 +				\$0.00	
<b>TOTAL NATIONAL FEE =</b>				\$666.00 <del>\$0.00</del>	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable). <input type="checkbox"/>				\$0.00	
<b>TOTAL FEES ENCLOSED =</b>				\$666.00 <del>\$0.00</del>	
				Amount to be: refunded	\$
				charged	\$

a. ☒ A check in the amount of \$666.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. \_\_\_\_\_ in the amount of \_\_\_\_\_ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 13-2855 A duplicate copy of this sheet is enclosed.

d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

**NOTE:** Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

Richard B. Hoffman  
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 6300 Sears Tower  
 233 South Wacker Drive  
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 Telecopy: 312/474-0448

*Richard B. Hoffman*

SIGNATURE

Richard B. Hoffman

NAME

26,910

REGISTRATION NUMBER

Feb. 19, 2002

DATE

PATENT  
Attorney Docket No.: 30151/38183

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: ) "EXPRESS MAIL" mailing label No.  
Bernd Lohmüller et al ) EV027097688US Date of Deposit: February  
Serial No. ) 19, 2002. I hereby certify that this paper (or  
Filed: ) fee) is being deposited with the United States  
Title: ANNEALING APPARATUS ) Postal Service "EXPRESS MAIL POST  
OFFICE TO ADDRESSEE" service under 37  
CFR §1.10 on the date indicated above and is  
addressed to: Commissioner for Patents,  
Washington, D.C. 20231  
)  
) Laura Frasher  
) Laura Frasher

GENERAL AUTHORIZATION UNDER 37 CFR 1.136(a)(3)

Commissioner for Patents  
Washington, D.C. 20231

Sir:

Applicants hereby request and authorize that any future reply concerning this design patent application requiring a petition for an extension of time under 37 CFR 1.136 for its timely submission be treated as incorporating a petition for extension of time for the appropriate length of time.

Respectfully submitted,

Bernd Lohmüller et al, Applicants

Date: Feb. 19, 2002

By Richard B. Hoffman  
Richard B. Hoffman, Reg. No. 26,910  
Attorney for Applicants

Marshall, Gerstein & Borun  
6300 Sears Tower, 233 South Wacker Drive  
Chicago, Illinois 60606-6357  
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PATENT

Attorney Docket No.: 30151/38183

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s): ) I hereby certify that this paper is being deposited  
Bernd Lohmüller et al ) with the United States Postal Service with  
Serial No.: 10/069,302 ) sufficient postage as first class mail in an  
Filed: February 19, 2002 ) envelope addressed to: Commissioner for  
For: ANNEALING APPARATUS ) Patents, Washington, D.C. 20231 on this date:  
March 12, 2002  
Richard B. Hoffman  
Richard B. Hoffman  
Registration No. 26,910  
Attorney for Applicants

PRELIMINARY AMENDMENT

Commissioner for Patents  
Washington, D.C. 20231

Sir:

In connection with the subject patent application, please enter the following amendment:

IN THE SPECIFICATION:

At page 1, after the title, please add a new centered heading as follows:

Field of the Invention

Page 1, after the first full paragraph, please add a new centered heading as follows:

Background of the Invention

Page 2, after the third full paragraph, please add a new centered heading as follows:

Summary of the Invention

Page 2, please delete the fifth paragraph and substitute with the following:

10069302-051002

A special aspect of the task of the invention is to provide an apparatus which allows for the simplified and improved technical engineering of cold processing and subsequent annealing of a metallic billet, and in particular a billet made of or containing aluminum.

Page 2, please delete the last two paragraphs on that page.

Page 3, please delete the first full paragraph and substitute with the following:

The present invention proposes an annealing apparatus for annealing a metallic billet which has at least two contact elements made of electrically conducting material which are electrically connected to a voltage source and induce an electrical current to flow through at least one respective segment of the billet when said billet is guided past to come into contact with said contact elements. The contact elements are made of a metal or a metal alloy which matches that of the billet's material to such an extent that basically no material from the billet diffuses into said contact elements. The contact elements are configured as contact plates.

Page 3, please delete the second full paragraph and substitute with the following:

The billet is preferably of a light metal or a light metal alloy. A billet made from aluminum or aluminum alloy is especially preferred. The contact element material is preferably that of the same light metal as is contained in the billet material. It is especially preferred when the contact element material is an alloy of the light metal.

Page 5, please delete the last full paragraph and substitute with the following:

The present annealing apparatus is preferably disposed with a cold-processing means for processing the billet in cold state whereby it is preferable to draw the billet into the cold-processing means. Particularly preferred is the physical positioning of the cold-processing means in front of an annealing path in the material flow direction. It is preferred to have a plurality of cold-processing means whereby one or more annealing paths are positioned after at least one of the cold-processing means in the material flow direction.

At page 6, please delete the second paragraph and substitute with the following:

The billet is preferably moved through the thin oil following the annealing process.

Page 6, please delete entire last paragraph with carryover to page 7, and substitute with the following:

It is preferred that the billet is moved in the transport direction from a cold-processing means through at least one annealing path and subsequently through a cooling section, whereby said cold-processing means is disposed with one or more dies of which a terminal die constitutes the last die in the transport direction. In thus doing, a protective gas atmosphere is provided between the terminal die and the preferably oil-employing cooling section.

Page 7, please delete the second full paragraph and substitute with the following:

It is preferred for the annealing apparatus to be disposed with a drawing means, particularly configured as a draw plate, and which can subject the billet to a force which induces the billet to be moved along the transport track at a consistently uniform tension. Such drawing means, draw plate respectively, is preferably disposed with a separate motor, or a motor which is allocated solely to the drawing means, for driving the drawing means, draw plate respectively.

Page 7, please delete the fourth full paragraph and substitute with the following:

It is especially preferred to have a regulating device control the rotational speeds of the different contact plates such that billet slippage is prevented, and notably also including when the billet expands subject to annealing path temperature. Certain predefined parameters can in particular be employed for the regulating control such as annealing temperature, or a parameter representative of the billet material, the length of the annealing path, the diameter of the billet, etc.

Page 7, please delete the fifth full paragraph and substitute with the following:

In a procedure in accordance with the present invention, the contact elements employed in the annealing apparatus preferably contain aluminum when a billet containing aluminum is to be annealed in said annealing apparatus. Such contact elements are connected to a voltage source such that a billet containing aluminum which comes into physical contact with the contact elements as it is passed by, receives an electrical current flow through its respective sections between the contact elements which induces a heating of the billet such that it is annealed at low stress.

Page 8, after third full paragraph, please add a new centered heading as follows:

#### Brief Description of the Drawings

Page 8, after description of Fig. 1, please add a new centered heading as follows:

#### Detailed Description of the Invention

Page 8, please delete the sixth paragraph and substitute with the following:

The annealing apparatus 10 depicted in Fig. 1 is disposed with a transport track 12 along which an aluminum-comprising billet 14 can be moved. The aluminum-comprising billet 14 is drawn through a die 18 arranged at the end of cold-processing means 16. The aluminum-comprising billet 14 is then moved through an area provided with protective gas 20. A part of this area in which the aluminum-comprising billet 14 is moved through the protective gas 20 is an annealing path 22.

Page 8, please delete the seventh full paragraph and substitute with the following:

The annealing path 22 is bordered by a first contact plate 24 and a second contact plate 26. The first contact plate 24, which is in particular a negative pole, is preferably a draw plate able to exert a force on the aluminum-comprising billet 14 so as to move it.

Page 8, please delete the eighth paragraph and substitute with the following:

The first contact plate 24 as well as the second contact plate 26 are both connected to a voltage source and comprise aluminum so that the billet positioned respectively at the annealing path 22 is heated. The billet is guided by various deflection rollers 28.

Page 9, please delete the first paragraph and substitute with the following:

Subsequent to annealing path 22, the aluminum-comprising billet 14 is moved along a second annealing path 30 which is bordered by the second contact plate 26 and a third contact plate 32.

Page 9, please delete the third paragraph and substitute with the following:

The aluminum-comprising billet 14 - already partly through annealing path 30 in the present given depiction - is cooled by a thin oil 34 prior to the oil being removed from the aluminum-comprising billet 14 by a stripping means, depicted here as die 36.

IN THE CLAIMS:

Please delete Claims at top of page and insert We Claim:

Please delete Claim Nos.1 through 19, without prejudice, and substitute the following Claim Nos. 20-51:

20. Annealing apparatus for annealing metallic billets, comprising at least two contact elements made of electrically conducting material which are electrically connected to a voltage source and which receive a billet in such a manner that said billet moves relative to said contact element and an electric current flows through said billet between said elements, and the material of at least one contact element is a metal alloy which is adapted to the material of said billet such that substantially no material from said billet diffuses into said contact element.

21. Apparatus according to claim 20, wherein said billet material is one of aluminum and an aluminum alloy and said contact element material is one of aluminum and an



aluminum alloy.

22. Apparatus according to claim 20, wherein said billet material is a light metal, and said contact element material is made from the same light metal or from an alloy of the same light metal.

23. Apparatus according to claim 20, wherein said billet material is one of aluminum and an aluminum alloy and said contact element material is one of aluminum and an aluminum alloy.

24. Apparatus according to claim 20, wherein said billet can be moved through said annealing apparatus along a predefined transport track.

25. Apparatus according to claim 20, wherein said contact elements between which said billet is contacted for electrical current flow through said billet are produced of substantially the same material.

26. Apparatus according to claim 20, further comprising a plurality of annealing paths, wherein one annealing path includes at least two contact elements for receiving a billet such that during the movement of said billet, an electrical current can flow through said billet between said contact elements and wherein one contact element is encompassed in one or more annealing paths.

27. Apparatus according to claim 20, further comprising at least one guiding means which does not function as contact element under certain circumstances, so that the billet is transported along predetermined sections of a transport track through said annealing apparatus without said billet being subjected to an electrical current flow in said sections.

28. Apparatus according to claim 27, wherein said guiding means comprise one of deflection rollers and comb rollers.

29. Apparatus according to claim 20, further comprising of at least one cold-

processing means through which said billet is drawn, said cold-processing means comprising at least one drawing die, wherein the last drawing in said cold-processing means in the material flow direction is a terminal die.

30. Apparatus according to claim 20, wherein at least one predetermined section of a transport track for moving said billet through said apparatus is a cooling section in which said billet can be cooled.

31. Apparatus according to claim 30, wherein said billet is moved through a cooling medium within said cooling section.

32. Apparatus according to claim 31, wherein said cooling medium is an oil.

33. Apparatus according to claim 30, further comprising a stripping means disposed after said cooling section and adapted to remove coolant from the surface of said billet, the stripping means including a drawing die, wherein said stripping means is arranged such that it can be cooled or lubricated by said coolant.

34. Apparatus according to claim 20, wherein said billet is moved through a protective gas in at least one predetermined section of a transport track for moving the billet through the apparatus.

35. Apparatus according to claim 20, further comprising a cold-processing means, cooling section and a transport track for moving said billet through the apparatus, wherein a section of said transport track arranged between said cold-processing means and said cooling section is provided with protective gas and wherein an annealing path is arranged on said transport track between said cold-processing means and said cooling section.

36. Apparatus according to claim 20, further comprising at least one drawing means for applying a force to said billet to cause said billet to move along a transport track through the apparatus.

37. Apparatus according to claim 36, wherein said drawing means is a draw disc.

38. Apparatus according to claim 20, wherein said at least two contact elements are provided with separate drive means.

39. Apparatus according to claim 38, further comprising a control and regulating means which controls said drive means of said contact elements so as to prevent any slippage of the billet due to the changing length of said billet.

40. Annealing apparatus for aluminum-containing billets, comprising at least two contact elements made of electrically conducting material which are electrically connected to a voltage source and which receive a billet in such a manner that said billet moves relative to said contact element and an electric current flows through said billet between said contact elements, and the material of at least one contact element is one of aluminum and an aluminum alloy into which substantially no material from said billet diffuses.

41. Apparatus according to claim 40, wherein said billet can be moved through said annealing apparatus along a predefined transport track.

42. Apparatus according to claim 40, further comprising a plurality of annealing paths, wherein one annealing path includes at least two contact elements for receiving a billet such that during the movement of said billet, an electrical current can flow through said billet between said contact elements and wherein one contact element is encompassed in one or more annealing paths.

43. Apparatus according to claim 40, further comprising of at least one cold-processing means through which said billet is drawn, said cold-processing means comprising at least one drawing die, wherein the last drawing die in said cold-processing means in the material flow direction is a terminal die.

44. Apparatus according to claim 40, wherein at least one predetermined section of a

transport track for moving said billet bracket through said apparatus is a cooling section in which said billet can be cooled.

45. Method of manufacturing a metallic, low-stress billet comprising the steps of:

transporting a billet along a transport track, such that said billet comes into contact with at least two contact elements, which are connected to a voltage source, in at least one predetermined section of said transport track;

allowing an electrical current to flow through a segment of said billet between said contact elements during the transport of said billet; and

selecting the material of said contact elements to match to the material of said billet, such that substantially no embrittlement or diffusion arises between the contact element material and the billet material during transport of said billet, or during the flowing of the current through said billet;

wherein the flow of said electrical current through said billet causes said billet to be annealed at low stress.

46. Method according to claim 45, wherein the contact elements are selected to contain aluminum, so as to transport an aluminum-containing billet and to anneal said billet at low stress.

47. Method according to claim 45, further comprising the step of cooling said billet following annealing by means of an oil.

48. Method according to claim 47, further comprising the step of stripping off said oil from said billet employing a drawing die.

Please add the following new claims:

49. Apparatus according to claim 32, wherein said oil is a thin oil.

50. Method according to claim 46, wherein the contact elements are selected to

contain an aluminum alloy.

51. Method according to claim 47, wherein the oil is a thin oil.

REMARKS

The claims have now been reviewed and a substitute set provided so as to conform to U.S. practice, but the claims have not been narrowed. The specification has been given headings, and an Abstract has been provided on a separate sheet. No new matter has been added.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "Version with markings to show changes made".

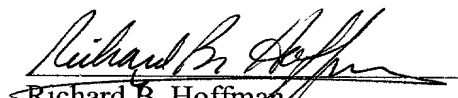
It is respectfully submitted the application as amended above is now in condition for substantive examination on the merits. If any claim or other fees are due by this Amendment, please charge our deposit account No. 13-2855.

Respectfully submitted,

Bernd Lohmüller et al, Applicants

Date:

March 12, 2002

  
Richard B. Hoffman  
Reg. No. 26,910  
Attorney for Applicants

Marshall, Gerstein & Borun  
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Telephone: 312/474-6300  
Telecopy: 312/474-0448

10069302.051002

## Abstract

An annealing apparatus for annealing metallic billets, particularly for use in annealing aluminum-containing billets, comprising at least two contact elements or contact discs made of electrically conducting material, the contact elements being connected to a voltage source so as to provide electric current flow through the billet as it passes between the two contact elements. The material of the contact elements is a light metal, normally aluminum or an aluminum-containing alloy, such that the contact element material is matched to the material of the billet and diffusion of the billet material into the contact element is substantially avoided.

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION:

At page 1, after the title, please add a new centered heading as follows:

--Field of the Invention--

Page 1, after the first full paragraph, please add a new centered heading as follows:

--Background of the Invention--

Page 2, after the third full paragraph, please add a new centered heading as follows:

--Summary of the Invention--

Page 2, please delete the fifth paragraph and substitute with the following:

--A special aspect of the task of the invention is to provide an apparatus which allows for the simplified and improved technical engineering of cold processing and subsequent annealing of a metallic billet, and in particular a billet made of or containing aluminum.--

Page 2, please delete the last two paragraphs on that page.

Page 3, please delete the first full paragraph and substitute with the following:

--The present invention proposes an annealing apparatus for annealing a metallic billet which has at least two contact elements made of electrically conducting material which are electrically connected to a voltage source and induce an electrical current to flow through at least one respective segment of the billet when said billet is guided past to come into contact with said contact elements. The contact elements are made of a metal or a metal alloy which matches that of the billet's material to such an extent that basically no material from the billet diffuses into said contact elements. The contact elements are configured as contact plates.--

Page 3, please delete the second full paragraph and substitute with the following:

--The billet is preferably of a light metal or a light metal alloy. A billet made from aluminum or aluminum alloy is especially preferred. The contact element material is

preferably that of the same light metal as is contained in the billet material. It is especially preferred when the contact element material is an alloy of the light metal.--

Page 5, please delete the last full paragraph and substitute with the following:

--The present annealing apparatus is preferably disposed with a cold-processing means for processing the billet in cold state whereby it is preferable to draw the billet into the cold-processing means. Particularly preferred is the physical positioning of the cold-processing means in front of an annealing path in the material flow direction. It is preferred to have a plurality of cold-processing means whereby one or more annealing paths are positioned after at least one of the cold-processing means in the material flow direction.--

At page 6, please delete the second paragraph and substitute with the following:

--The billet is preferably moved through the thin oil following the annealing process.--

Page 6, please delete entire last paragraph with carryover to page 7, and substitute with the following:

--It is preferred that the billet is moved in the transport direction from a cold-processing means through at least one annealing path and subsequently through a cooling section, whereby said cold-processing means is disposed with one or more dies of which a terminal die constitutes the last die in the transport direction. In thus doing, a protective gas atmosphere is provided between the terminal die and the preferably oil-employing cooling section.--

Page 7, please delete the second full paragraph and substitute with the following:

--It is preferred for the annealing apparatus to be disposed with a drawing means, particularly configured as a draw plate, and which can subject the billet to a force which induces the billet to be moved along the transport track at a consistently uniform tension. Such drawing means, draw plate respectively, is preferably disposed with a separate motor, or



a motor which is allocated solely to the drawing means, for driving the drawing means, draw plate respectively.--

Page 7, please delete the fourth full paragraph and substitute with the following:

--It is especially preferred to have a regulating device control the rotational speeds of the different contact plates such that billet slippage is prevented, and notably also including when the billet expands subject to annealing path temperature. Certain predefined parameters can in particular be employed for the regulating control such as annealing temperature, or a parameter representative of the billet material, the length of the annealing path, the diameter of the billet, etc.--

Page 7, please delete the fifth full paragraph and substitute with the following:

--In a procedure in accordance with the present invention, the contact elements employed in the annealing apparatus preferably contain aluminum when a billet containing aluminum is to be annealed in said annealing apparatus. Such contact elements are connected to a voltage source such that a billet containing aluminum which comes into physical contact with the contact elements as it is passed by, receives an electrical current flow through its respective sections between the contact elements which induces a heating of the billet such that it is annealed at low stress.--

Page 8, after third full paragraph, please add a new centered heading as follows:

--Brief Description of the Drawings--

Page 8, after description of Fig. 1, please add a new centered heading as follows:

--Detailed Description of the Invention--

Page 8, please delete the sixth paragraph and substitute with the following:

--The annealing apparatus 10 depicted in Fig. 1 is disposed with a transport track 12 along which an aluminum-comprising billet 14 can be moved. The aluminum-comprising

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billet 14 is drawn through a die 18 arranged at the end of cold-processing means 16. The aluminum-comprising billet 14 is then moved through an area provided with protective gas 20. A part of this area in which the aluminum-comprising billet 14 is moved through the protective gas 20 is an annealing path 22.--

Page 8, please delete the seventh full paragraph and substitute with the following:

--The annealing path 22 is bordered by a first contact plate 24 and a second contact plate 26. The first contact plate 24, which is in particular a negative pole, is preferably a draw plate able to exert a force on the aluminum-comprising billet 14 so as to move it.--

Page 8, please delete the eighth paragraph and substitute with the following:

--The first contact plate 24 as well as the second contact plate 26 are both connected to a voltage source and comprise aluminum so that the billet positioned respectively at the annealing path 22 is heated. The billet is guided by various deflection rollers 28.--

Page 9, please delete the first paragraph and substitute with the following:

--Subsequent to annealing path 22, the aluminum-comprising billet 14 is moved along a second annealing path 30 which is bordered by the second contact plate 26 and a third contact plate 32.--

Page 9, please delete the third paragraph and substitute with the following:

--The aluminum-comprising billet 14 - already partly through annealing path 30 in the present given depiction - is cooled by a thin oil 34 prior to the oil being removed from the aluminum-comprising billet 14 by a stripping means, depicted here as die 36.--

**JOINT INVENTORS**

30151/38183

"EXPRESS MAIL" mailing label No.

EV027097688US.

Date of Deposit: February 19, 2002

I hereby certify that this paper (or fee) is  
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20231

Laura Frasher  
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**APPLICATION FOR  
UNITED STATES LETTERS PATENT**

**S P E C I F I C A T I O N**

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**TO ALL WHOM IT MAY CONCERN:**

Be it known that we, Bernd Lohmüller, a citizen of Germany,  
residing at Fuchsgraben 37, 91126 Schwabach, Germany, and Rainer  
Vockentanz, a citizen of Germany, residing at Walpersdorfer Strasse 26a,  
91126 Schwabach, Germany, a citizen of Germany have invented a new and  
useful ANNEALING APPARATUS, of which the following is a specification.

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**Annealing apparatus**

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The present invention relates to an annealing apparatus for the annealing of metallic billets and especially for the annealing of billets containing aluminum, as well as a procedure of manufacturing metallic, low-stressed billets, particularly metallic low-stressed billets which contain aluminum.

A billet in the sense of the present invention is in particular a metallic wire which has an integrally-formed cross-sectional area perpendicular to its longitudinal axis or a bundle of such metallic wires.

Subsequent to the cold processing of a metallic billet, and especially after a metallic billet has been drawn, structural changes can be observed in said metallic billet, which is also especially the case with billets made of aluminum or aluminum alloys. These structural changes in particular have an effect of hardening the billet and reducing its elongation at rupture. Such structural changes limit the uses for a billet so that a feasible measure to remedy same consists in stress-relief annealing of the billet, which induces a re-crystallization of its structure. In so doing, the billet is heated employing direct resistance heating for engineering and economic reasons. This direct resistance heating integrates a section of the billet, respectively one billet segment at a time, into an electrical circuit so that an electric current flows through said billet section or segment and, due to the electrical resistance of the billet, at least a portion of the electrical energy is converted to thermal energy, hence heating the billet.

During resistance heating, respectively annealing, the billet is guided, for example continuously, along a plurality of contact plates. Said contact plates are connected to a voltage source such that a current can flow through the metallic billet.

Considerable problems arise when current is transmitted from contact plates to billets containing aluminum or aluminum alloys. Such problems give rise to having to operate

these types of devices in a cost-intensive manner and result in the quality of the annealed billet not remaining constant over time.

The inventor is additionally aware that billets made of aluminum or of an aluminum alloy are heated in furnaces (furnace or drop annealing) in batch processing. Thus, the billets supported on a metallic spool or other metallic carrier are subjected to a protective gas atmosphere in an annealing furnace for a period of several hours.

Such a process necessitates great technical production expenditures as well as being energy and cost-intensive and furthermore gives rise to extremely long passage times with high process costs and frequently inadequate product quality.

The inventor is moreover aware that in the production of rods, wire is annealed employing a consumptionally annealing passage process based on a conductive principle, although the quality of such products is generally insufficient in this case as well.

It is thus the task of the present invention to provide an annealing apparatus for the treatment of a metallic billet, and particularly for the annealing of a billet which contains aluminum, as well as a method of manufacturing a metallic, low-stressed billet, and most notably a low-stressed billet which contains aluminum, in which electrical current can be transmitted to the billet in an economical and structurally simple manner of engineering over short passage times, so that as a result of said current flow, at least a section thereof will be heated, whereby the contact elements transferring the electrical current to the billet will enjoy a long operating life.

A special aspect of the task of the invention is to provide a apparatus which allows for the simplified and improved technical engineering of cold processing and subsequent annealing of a metallic billet, and in particular a billet made of or containing aluminum.

This task is solved by an annealing apparatus in accordance with claim 1.

An inventive process is the object of claims 16 and 18.

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Preferred embodiments of the invention comprise the subject matter of the subclaims. The present invention proposes an annealing apparatus for annealing a metallic billet which has at least two contact elements made of electrically conducting material which are electrically connected to a voltage source and induce an electrical current to flow through at least one respective segment of the billet when said billet is guided past to come into contact with said contact elements. Said contact elements are made of a metal or a metal alloy which matches that of the billet's material to such an extent that basically no material from the billet diffuses into said contact elements. Said contact elements are configured as contact plates.

The billet is preferably of a light metal or a light metal alloy. A billet made from aluminum or aluminum alloy is especially preferred. The contact element material is preferably that of the same light metal as is contained in the billet material. It is especially preferred when the contact element material is an alloy of said light metal.

The voltage source may be a three-phase or a direct current source.

The annealing apparatus according to the present invention enables the producing of annealed billet material made of aluminum or aluminum alloy or the like in a technically simple as well as energy and cost-efficient manner, and most notably particularly with a high product quality and low waste factor. Furthermore, the present invention allows for reduced passage times at lower process costs during the manufacture of an annealed billet made of aluminum or aluminum alloy or the like.

Thus, the present invention can, for example, reduce the number of process steps by eliminating the need for a furnace when annealing. Related procedural expenditures are likewise eliminated such as an additional spool transport or needing to respool from the wire spools used in the furnace to synthetic spools used for transport. Since the present invention eliminates the need for lengthy warm-up and continuous heating phases of a wire drum in a furnace, it enables an increase in productivity and a shortening of the passage times. Additionally, an annealing apparatus in accordance with the present invention can be employed very flexibly, having a positive and process-simplifying effect when, for example, annealing different sized drums or differing wire materials.

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The quality of an annealed billet produced with the inventive annealing apparatus is improved compared to annealed billets produced especially in furnaces. Waste is likewise reduced. This can be attributed to the present invention precluding such contingencies such as, for example, the wire material sticking to a spool or a wire drum during or after furnace annealing treatment and/or frequently continuing an undesired re-crystallization during the cooling-down phase.

The invention also has advantages from an energy-saving point of view since it avoids any additional expenditure of wasted energy as arises in furnace annealing with respect to, for example, the unnecessary heating of spools or wire drum carriers.

Moreover, the contact elements of the present invention do not exhibit any significant wear. Additionally, the wire surface suffers no damage at the contact points in accordance with the present invention.

Especially preferred is the detachable arrangement of the contact elements, contact plates respectively, on the annealing apparatus so that they may be replaced by others if another type of billet material is to be heated, respectively annealed in said annealing apparatus.

The electrical current is preferably transmitted from the voltage source to the contact elements by means of brushes or the like. The billet material is preferably moved through said annealing apparatus along a predefined transport track through said annealing apparatus, whereby especially a guiding means such as deviating or comb rollers or the like are hereto provided. Especially preferred are guiding means which do not function as contact elements under certain set circumstances so that the billet being transported along the transport track is not subjected to an electrical current flow at predetermined sections within the annealing apparatus.

It is preferred to have a plurality of annealing paths arranged along the transport track whereby one annealing path is disposed at an area of the transport track where the billet, or a portion of the billet, or the segment of the billet presently at this point

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receives a flow of electrical current as transmitted to the billet by means of the contact elements.

According to a preferred embodiment of the present invention, various different annealing paths of differing lengths and/or which allow for the feeding of varying electrical current energy to the billet are disposed along the transport track.

The invention is in this respect advantageous as it enables significantly prolonging the operating life of the contact plates, contact elements respectively. Hence the invention particularly enables annealing of an aluminum billet by means of conductive heating, respectively direct resistance heating in an economical manner whereby the contact elements are not quickly destroyed, for example just after 15 or 30 minutes.

The invention consequently avoids the situation of aluminum from the billet diffusing into the contact elements which induces intermetallic phases to form in the contact elements and cause material embrittlement. Such material embrittlement causes track grooves to form on the contact elements which in turn can lead to the billet material slipping on the contact elements such that frictional wear results and leads to further destruction of the contact elements or to damaging of the billet.

According to a preferred embodiment of the present invention, the contact elements which are positioned at the same annealing path, meaning in particular the contact element which functions as a positive pole and the contact element which functions as its associated negative pole, are made of the same material.

The present annealing apparatus is preferably disposed with a cold-processing means for processing the billet in cold state whereby it is preferable to draw the billet into said means. Particularly preferred is the physical positioning of said cold-processing means in front of an annealing path in the material flow direction. It is preferred to have a plurality of cold-processing means whereby one or more annealing paths are positioned after at least one of said cold-processing means in the material flow direction.

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A preferred annealing apparatus in accordance with the present invention is provided with a cooling section as a part of the transport track in which the billet may be cooled. A cooling means or medium is provided for cooling the billet. A billet may be cooled by using oil within the cooling section, with a thin oil being hereby especially preferred.

The billet is preferably moved through said thin oil following the annealing process.

The use of oil as a coolant is in this respect advantageous since oil prevents the formation of oxidation build-up on the surface of a billet or the surface of a billet containing aluminum.

Contingent upon the subsequent use of the billet, when using oil as a coolant, it is preferred to use oil which will essentially have no damaging effects on health.

The use of such an oil is in this respect advantageous because the billet will then be safe to use for clips or staples or other such similar articles which may come into contact with food.

The present annealing apparatus is preferably disposed with a stripping or similar means for removing any coolant or other residue from the surface of the billet. The stripping means is preferably physically positioned after the cooling section in the material flow direction. The stripping means is preferably configured as a die.

The stripping means, which is particularly preferably configured as a die, is preferably cooled and/or lubricated with the same cooling oil as used in the cooling means.

According to an especially preferred embodiment of the present invention, the billet is moved through a protective gas atmosphere at predetermined sections of the transport track with pure nitrogen in particular being hereto employed as a protective gas.

It is preferred that the billet is moved in the transport direction from a cold-processing means through at least one annealing path and subsequently through a cooling

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section, whereby said cold-processing means is disposed with one or more dies of which a terminal die constitutes the last die in the transport direction. In thus doing, a protective gas atmosphere is provided between said terminal die and said preferably oil-employing cooling section.

The protective gas atmosphere prevents the formation of oxidation build-up on billets and most particularly on billets which contain aluminum.

It is preferred for the annealing apparatus to be disposed with a drawing means, particularly configured as a draw plate, and which can subject the billet to a force which induces same to be moved along the transport track at a consistently uniform tension. Such drawing means, draw plate respectively, is preferably disposed with a separate motor, or a motor which is allocated solely to said drawing means, for driving said drawing means, draw plate respectively.

This allows for catching any possible increases in billet speed due to thermal expansion or diameter shrinkage.

It is especially preferred to have a regulating device control the rotational speeds of the different contact plates such that billet slippage is prevented, and notably also including when the billet expands subject to annealing path temperature. Certain predefined parameters can in particular be employed for said regulating control such as annealing temperature, or a parameter representative of the billet material, the length of the annealing path, the diameter of the billet, etc.

In a procedure in accordance with the present invention, the contact elements employed in the annealing apparatus preferably contain aluminum when a billet containing aluminum is to be annealed in said annealing apparatus. Said contact elements are connected to a voltage source such that a billet containing aluminum which comes into physical contact with said contact elements as it is passed by, receives an electrical current flow through its respective sections between said contact elements which induces a heating of the billet such that it is annealed at low stress.

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Following annealing, the billet, and most particularly a billet containing aluminum, is preferably cooled by means of an oil, and in particular a thin oil.

The oil fed to cool the billet is preferably stripped off following the cooling process, and most particularly by the employing of a die.

The present invention encompasses a number of additional exemplary embodiments, the description of individual embodiments is not to be considered as waived.

In the following, the invention will be described in greater detail with reference to the drawing, which is not to be considered as restricting of the present invention, and which shows:

Fig. 1 shows a schematic partial cut-away view of an exemplary embodiment in accordance with the present invention.

The annealing apparatus 10 depicted in Fig. 1 is disposed with a transport track 12 along which an aluminum-comprising billet 14 can be moved. Said aluminum-comprising billet 14 is drawn through a die 18 arranged at the end of cold-processing means 16. Said aluminum-comprising billet 14 is then moved through an area provided with protective gas 20. A part of this area in which said aluminum-comprising billet 14 is moved through said protective gas 20 is an annealing path 22.

Said annealing path 22 is bordered by a first contact plate 24 and a second contact plate 26. Said first contact plate 24, which is in particular a negative pole, is preferably a draw plate able to exert a force on said aluminum-comprising billet 14 so as to move it.

Said first contact plate 24 as well as said second contact plate 26 are both connected to a voltage source and comprise aluminum so that the billet positioned respectively at said annealing path 22 is heated. The billet is guided by various deflection rollers 28.

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Subsequent to annealing path 22, said aluminum-comprising billet 14 is moved along a second annealing path 30 which is bordered by said second contact plate 26 and a third contact plate 32.

Contact plates 32, 24 have the identical potential, which differs from the potential of contact plate 26.

Said aluminum-comprising billet 14 – already partly through annealing path 30 in the present given depiction – is cooled by a thin oil 34 prior to said oil being removed from said aluminum-comprising billet 14 by a stripping means, depicted here as die 36.

Annealing apparatus 10 is further disposed with a second draw plate which applies such a force on said aluminum-comprising billet 14 so as to move it.

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## Claims

1. Annealing apparatus for the annealing metallic billets (14), especially for the annealing of aluminum-comprising billets (14), comprising at least two contact elements such as contact plates (24, 26, 32) made of electrically conducting material which are electrically connected to a voltage source and which receive a billet (14) in such a manner that said billet (14) moves relative to said contact elements and an electric current flows through said billet (14) between said contact elements

### **characterized in that**

the material of at least one of said contact element is of a metal alloy which matches that of the material of said billet (14) to such an extent that substantially no material from said billet (14) diffuses into said contact element.

2. Annealing apparatus particularly according to one of the preceding claims,  
**characterized in that**  
said billet material is a light metal, preferably aluminum, and said contact element material is made from the same said light metal or from an alloy of the same said light metal.

3. Annealing apparatus particularly according to one of the preceding claims,  
**characterized in that**  
said billet (14) can be moved through said annealing apparatus (10) along a predefined transport track (12).

4. Annealing apparatus particularly according to one of the preceding claims,  
**characterized in that**  
said contact elements between which said billet (14) can be connected such that an electrical current flows through said billet (14) between said contact elements are substantially produced of the same material.

5. Annealing apparatus particularly according to one of the preceding claims,  
**characterized in that**  
same is provided with a plurality of annealing paths (22, 30), whereby an annealing path (22, 30) has at least two contact elements for receiving a billet (14) such that during the movement of said billet (14), an electrical current can flow through said billet (14) between said contact elements and whereby a contact element is encompassed in one or more annealing paths (22, 30).
6. Annealing apparatus particularly according to one of the preceding claims,  
**characterized in that**  
same is provided with at least one guiding means such as deviating rollers (28) or comb rollers or the like which do not function as contact elements under certain set circumstances so that the billet (14) can be transported along predetermined sections of said transport track (12) through said annealing apparatus (10) without said billet (14) being subjected to an electrical current flow at said sections.
7. Annealing apparatus particularly according to one of the preceding claims,  
**characterized in that**  
same is provided with at least one cold-processing means (16) through which said billet (14) is drawn, whereby said cold-processing means (16) is disposed with preferably at least one die (18) and whereby the last die (18) in said cold-processing means (16) in the material flow direction is a terminal die.
8. Annealing apparatus particularly according to one of the preceding claims,  
**characterized in that**  
at least one predetermined section of said transport track (12) is a cooling section in which said billet (14) can be cooled.

9. Annealing apparatus particularly according to claim 8, **characterized in that** said billet (14) is moved through a cooling medium within said cooling section which is preferably an oil (34), particularly preferably a thin oil (34).
10. Annealing apparatus particularly according to one of claims 8 or 9, **characterized in that** same is provided with a stripping or similar means able to remove a coolant or the like from the surface of said billet (14) and which in particular is provided with a die (36), whereby said stripping means is preferably arranged such that it can be cooled and/or lubricated by said coolant.
11. Annealing apparatus particularly according to one of the preceding claims, **characterized in that** said billet (14) is moved through a protective gas (20) or the like in at least one predetermined section of said transport track (12).
12. Annealing apparatus particularly according to one of the preceding claims, **characterized in that** said transport track (12) for said billet (14) extends through a cold-processing means (16) as well as through a cooling section, whereby a section of said transport track (12) arranged between said cold-processing means (16) and said cooling section is provided with protective gas (20) or the like and whereby an annealing path (22, 30) is preferably arranged on said transport track (12) between said cold-processing means (16) and said cooling section.

13. Annealing apparatus particularly according to one of the preceding claims, **characterized in that** same is provided with at least one drawing means, such as a draw plate or the like, which can subject the billet (14) to a force which induces said billet (14) to be moved along the transport track (12).
14. Annealing apparatus particularly according to one of the preceding claims, **characterized in that** at least two and preferably all contact plates (24, 26, 32) are provided with separate drive means.
15. Annealing apparatus particularly according to claim 14, **characterized in that** same is provided with a control and/or regulating means which controls said drive means of said contact plates (24, 26, 32) so as to prevent any slippage of billet (14) in consideration of changing length of said billet (14).
16. Method of manufacturing a metallic, low-stress billet (14), particularly a low-stress billet (14) containing aluminum, comprising the following steps:  
transporting a billet (14) along a transport track (12), and notably in such a manner that said billet (14) comes into contact with at least two contact elements, which are connected to a voltage source, in at least one predetermined section of said transport track (12) such that an electrical current flows through a segment of said billet (14) between said contact elements during the transport of said billet (14), whereby the material of said contact elements is selected and/or matched to the material of said billet such that essentially no embrittlement and/or diffusion between the contact element material and the billet material will occur during transport of said billet (14) and/or during the flowing of the current through said billet (14), whereby the flow of said electrical current through said billet (14) induces said billet (14) to be annealed at low stress.



17. Method according to claim 16, comprising the step of selecting contact elements which contain aluminum, and in particular an aluminum alloy, so as to subsequently transport an aluminum-comprising billet (14) such that said billet (14) is annealed at low stress.
18. Method for manufacturing a low-stressed billet (14), when embodied with the features of claim 14 or claim 15, comprising the step of cooling said billet (14) following annealing by means of an oil (34), preferably a thin oil.
19. Method according to claim 18, comprising the step of stripping off said oil (34) from said billet (14), and in particular by means of a die (36).

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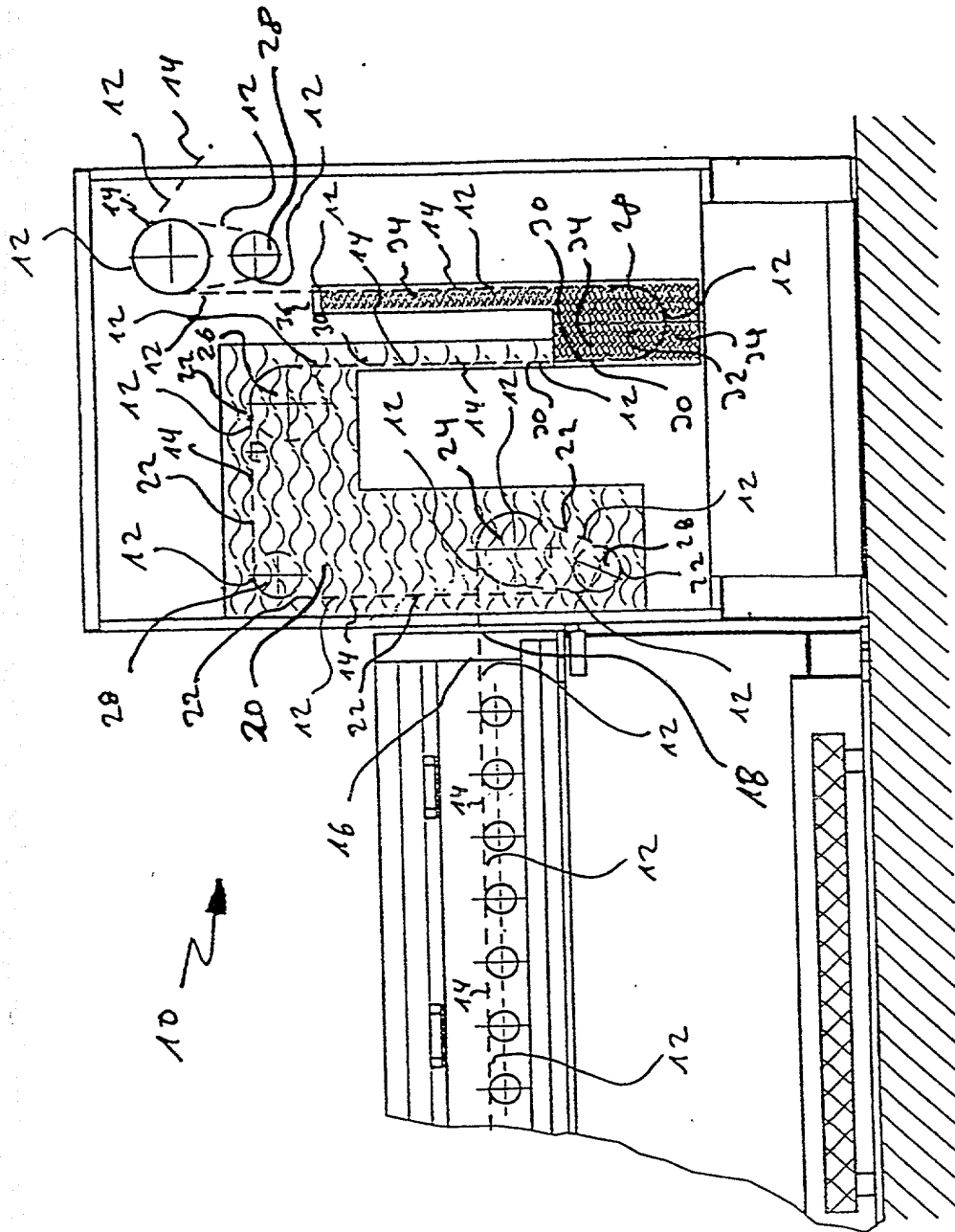
### Abstract

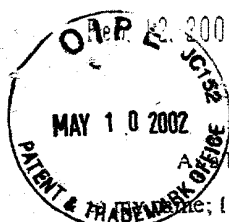
An annealing apparatus is provided for annealing metallic billets, particularly for use in annealing aluminum-containing billets. The apparatus comprises at least two contact elements or contact discs made of electrically conducting material. The contact elements are connected to a voltage source so as to provide electric current flow through the billet as it passes between the two contact elements. The material of the contact elements is a light metal, normally aluminum or an aluminum-containing alloy, such that the contact element material is matched to the material of the billet. In this manner, diffusion of the billet material into the contact element is substantially avoided.

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DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY

A below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name; I believe that I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled "ANNEALING APPARATUS," the specification of which (check one): ☒ is attached hereto; ☐ was filed on February 19, 2002 as Application Serial No. 10/069,302 and was amended on \_\_\_\_\_ (if applicable); ☐ was filed as PCT International Application No. \_\_\_\_\_ on \_\_\_\_\_ and was amended under Article 19 on \_\_\_\_\_ (if applicable). I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment(s) referred to above. I acknowledge the duty to disclose to the Patent and Trademark Office all information known to me to be material to patentability as defined in 37 C.F.R. §1.56.

I hereby claim foreign priority benefits under 35 U.S.C. §119 of any foreign application(s) for patent or inventor's certificate or of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

199 39 399.0	Germany	19 August 1999	Priority Claimed	
(Application Serial Number)	(Country)	(Day/Month/Year Filed)	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
_____	_____	_____	<input type="checkbox"/> Yes	<input type="checkbox"/> No
(Application Serial Number)	(Country)	(Day/Month/Year Filed)		

I hereby claim the benefit under 35 U.S.C. §119(e) of any United States provisional application(s) listed below:

_____	_____
(Application Serial Number)	(Day/Month/Year Filed)
_____	_____
(Application Serial Number)	(Day/Month/Year Filed)

I hereby claim the benefit under 35 U.S.C. §120 of any United States application(s) or PCT international application(s) designating the United States of America listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior application(s) in the manner provided by the first paragraph of 35 U.S.C. §112, I acknowledge the duty to disclose to the Office all information known to me to be material to patentability as defined in 37 C.F.R. §1.56 which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application:

PCT/EP00/08050	17 August 2000	Pending
(Application Serial Number)	(Day/Month/Year Filed)	(Status-Patented, Pending or Abandoned)
_____	_____	_____
(Application Serial Number)	(Day/Month/Year Filed)	(Status-Patented, Pending or Abandoned)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. §1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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## APPLICABLE RULES AND STATUTES

## 37 CFR 1.56. DUTY OF DISCLOSURE - INFORMATION MATERIAL TO PATENTABILITY (Applicable Portion)

(a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is canceled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is canceled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§ 1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

- (1) prior art cited in search reports of a foreign patent office in a counterpart application, and
- (2) the closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentability defines, to make sure that any material information contained therein is disclosed to the Office.

Information relating to the following factual situations enumerated in 35 USC 102 and 103 may be considered material under 37 CFR 1.56(a).

## 35 U.S.C. 102. CONDITIONS FOR PATENTABILITY: NOVELTY AND LOSS OF RIGHT TO PATENT

A person shall be entitled to a patent unless --

- (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for patent, or
- (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of the application for patent in the United States, or
- (c) he has abandoned the invention, or
- (d) the invention was first patented or caused to be patented, or was the subject of an inventor's certificate, by the applicant or his legal representatives or assigns in a foreign country prior to the date of the application for patent in this country on an application for patent or inventor's certificate filed more than twelve months before the filing of the application in the United States, or
- (e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraph (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent, or
- (f) he did not himself invent the subject matter sought to be patented, or
- (g) before the applicant's invention thereof the invention was made in this country by another who had not abandoned, suppressed, or concealed it. In determining priority of invention there shall be considered not only the respective dates of conception and reduction to practice of the invention, but also the reasonable diligence of one who was first to conceive and last to reduce to practice, from a time prior to conception by the other.

## 35 U.S.C. 103. CONDITIONS FOR PATENTABILITY; NON-OBVIOUS SUBJECT MATTER (Applicable Portion)

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Subject matter developed by another person, which qualifies as prior art only under subsection (f) or (g) of section 102 of this title, shall not preclude patentability under this section where the subject matter and the claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person.

## 35 U.S.C. 112. SPECIFICATION (Applicable Portion)

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

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